CLAIMS

We claim:

1. A transformer embedded in an LTCC substrate, comprising:

a ceramic substrate;

a ceramic toroidal core embedded within said ceramic substrate; and

at least one conductive coil comprising a plurality of turns about said ceramic toroidal core, wherein said ceramic toroidal core is integrally formed with said ceramic substrate in a co-firing process.

2. The transformer according to claim 1 wherein said plurality of turns are contained within said ceramic substrate at all points.

3. The transformer according to claim 1 wherein said ceramic toroidal core is comprised of a ceramic material that has a permeability greater than a second ceramic material comprising at least one other portion of said ceramic substrate.

4. The transformer according to claim 1 further comprising at least one conductive metal ground plane layer disposed within said ceramic substrate.

5. The transformer according to claim 4 wherein said ground plane layer is interposed between said conductive coil and at least one surface mount component disposed on a surface of said ceramic substrate.

6. The transformer according to claim 1 further comprising a second conductive coil including a plurality of turns disposed about said ceramic toroidal core and having a coil radius different from said first conductive coil.

7. The transformer according to claim 1 further comprising a second conductive coil formed of a plurality of turns disposed about a radial portion of said ceramic toroidal core exclusive of a second radial portion of said ceramic toroidal core where said first

conductive coil is disposed.

8. The transformer according to claim 1 wherein said transformer is an autotransformer.

9. The transformer according to claim 1 wherein at least a portion of said ceramic toroidal core region has a permeability greater than one.

10. A method for forming a transformer in a ceramic substrate, comprising the steps of:

forming at least one conductive coil comprising a plurality of turns about an unfired ceramic toroidal core region defined within an unfired ceramic substrate; and

co-firing said unfired ceramic toroidal core region, said unfired ceramic substrate, and said conductive coil to form an integral ceramic substrate structure with said conductive coil at least partially embedded therein.

11. The method according to claim 10, further comprising the step of forming at least a portion of said ceramic toroidal core region of a ceramic material having a permeability greater than one.

12. The method according to claim 10 further comprising the step of disposing a conductive ground plane layer between said conductive coil and an outer surface of said ceramic substrate.

13. The method according to claim 12 further comprising the step of disposing said ground plane layer between said conductive coil and at least one surface mount component disposed on a surface of said ceramic substrate.

14. The method according to claim 10 further comprising the step of forming a second conductive coil including a plurality of turns disposed about said ceramic toroidal core.

15. The method according to claim 14 further comprising the step of selecting a coil radius of said second conductive coil to be different from a coil radius of said first conductive coil.

16. The method according to claim 10 further comprising the step of forming a second conductive coil of a plurality of turns disposed about a radial portion of said ceramic toroidal core exclusive of said radial portion of said ceramic toroidal core where said first conductive coil is disposed.

17. The method according to claim 10 further comprising the step of providing at least one tap along a length of said conductive coil to form an autotransformer.

18. A method for forming a transformer in a ceramic substrate, comprising the steps of:

forming a plurality of vias and traces in an unfired ceramic substrate to define least one conductive coil comprising a plurality of turns about an unfired ceramic toroidal core region defined within said; and

co-firing said unfired ceramic toroidal core region, said unfired ceramic substrate, and said conductive coil to form an integral ceramic substrate structure with said conductive coil at least partially embedded therein.

19. The method according to claim 18 further comprising the step of forming said vias from a conductive metal paste.

20. The method according to claim 18, further comprising the step of forming at least a portion of said ceramic toroidal core region of a ceramic material having a permeability greater than one.

21. The method according to claim 18 further comprising the step of disposing a conductive ground plane layer between said conductive coil and an outer surface of

said ceramic substrate.

22. The method according to claim 21 further comprising the step of disposing said ground plane layer between said conductive coil and at least one surface mount component disposed on a surface of said ceramic substrate.

23. The method according to claim 18 further comprising the step of forming a second conductive coil from a plurality of conductive vias and conductive traces to define a plurality of turns disposed about said ceramic toroidal core.

24. The method according to claim 23 further comprising the step of selecting a coil radius of said second conductive coil to be different from a coil radius of said first conductive coil.

25. The method according to claim 18 further comprising the step of forming a second conductive coil of a plurality of turns disposed about a radial portion of said ceramic toroidal core exclusive of said radial portion of said ceramic toroidal core where said first conductive coil is disposed.

26. The method according to claim 18 further comprising the step of providing at least one tap along a length of said conductive coil to form an autotransformer.